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(72) Inventor HENRY DANIELS

(19)

(54) IMPROVEMENTS IN OR RELATING TO NON-RETURN VALVES

(71) We, HAWKER SIDDELEY DYNAMICS LIMITED, a British Company of Manor Road, Hatfield, Hertfordshire, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed to be particularly described in and by the following statement:—

The present invention relates to non-return valves of the flexible flap closure type.

Existing valves of this type, employing two half-circular hinged flaps to prevent flow in one direction, offer fairly high resistance to the passage of fluid past the central mounting support when in the open position, this resistance being caused by the configuration of the hinges and associated support means obstructing a significant proportion of the passageway. In addition, such flap valves are relatively complicated in their construction and liable to damage in use.

It is an object of the invention to achieve an improved flap valve incorporating a hinging member that offers less resistance to the passage of fluid.

According to the present invention, there is provided a non-return valve of the flexible flap closure type comprising a generally cylindrical valve body, a diametral support bridge across the interior of the body and generally semi-circular valve flaps hinged on said support bridge so as to swing in the downstream direction under differential pressure from a position in which they engage a seat ring around the interior wall of the valve body and block the flow passage to a position in which they lie on opposite sides of the support bridge in planes generally parallel to the flow direction, and wherein the valve flaps are provided by the two halves of a generally circular folding flap member, have a central diametral region clamped to the support bridge and internal resilient reinforcing elements extending within said two semi-circular flaps to sustain back pressure and provide a closing bias.

The invention thereby provides a composite form of hinging member and associated support means capable of withstanding considerable pressure when the valve is in the closed position and being sufficiently robust in construction to withstand rapid changes in direction of flow past the same.

The nature of the invention will be more clearly understood from the following description of arrangements in accordance therewith, given by way of example and with reference to the accompanying drawings, in which:—

Figure 1 is a cutaway illustration of a valve embodying the invention,

Figure 2 illustrates an aspect of the operation of the valve of Figure 1,

Figure 3 shows a modification of the valve, and

Figure 4 illustrates another modification.

Referring firstly to Figure 1, this shows a valve for employment to control atmospheric air flow, for example a valve allowing air to enter a pressurised area but preventing it from leaving. In this particular application a high pressure differential may exist between opposite sides of a hinging circular flap member 1 when in its closed position. To prevent the flap member 1 distorting under this pressure condition it is necessary to provide internal reinforcement elements 2 which are secured between outer plies of the two flaps of the flap member 1. The reinforcement elements 2 are resilient and have a slight natural curvature. Further reinforcement 3 may be provided across the thickened central region of the flap member 1 to strengthen the hinge area.

The actual valve may be formed in three parts, namely two coaxial annular casing segments 4, 5 arranged with their ends in contiguity, and a support and flap-seating ring 6 fitted within the casing and having a peripheral shoulder lodged in a recess in the internal wall of the segment 4. Disposed diametrically across the casing segment 4, and fastened thereto at its ends, is a support bridge 7 to which is affixed the flap member

1, the member 1 being clamped against one edge of the bridge 7 by a rib member 8 which serves as a leading edge for the support bridge in the air flow, this leading edge being of aerofoil or bullet profile section.

It will be seen that when the valve is open the hinged flap member 1 (in broken outline) folds into a position of minimum resistance to the air flow passing it on either side, the opposite faces of the bridge member 7 being contoured with concavities such as to accommodate the contours of the downstream faces of the two flaps of the flap member 1. Thus, although the flaps of the flap member 1 are thickened and curved by the insertion of the reinforcing elements 2, this causes no increase in the resistance to flow when the valve is open. The contouring of the faces of the support bridge 7 has the effect of forming two lateral lobes 11 on the support bridge around which the material of the flap member 1 rolls as the flaps hinge.

Figure 2 shows a similar configuration of the flap member 1, but the chain-dotted line A—A indicates in an exaggerated form the curvature that the reinforcement elements 2 naturally assume when little or no back pressure is applied to hold the hinged flap member 1 in the closed position against the seat ring 6. Due to the resilient nature of the flap member 1 and the reinforcement elements 2 this configuration is maintained until sufficient pressure differential exists to cause the flap member to flatten.

To add to the closing effort of the flap member 1, the upstream side of this member may be tensioned by so shaping the surfaces of the support bridge 7 and rib member 8 in contact with the flap member 1 that a central diametral area of the flap member is depressed into a recess 10 formed in the support bridge 7. Figure 3 shows one method of achieving this. The inclusion of internal reinforcement serves to stiffen the flap member locally, enabling the flap member 1 to be more greatly pre-loaded between the bridge 7 and rib member 8 by being deformed in the manner indicated by the lines B—B.

Figure 4 shows an alternative form of the rib member 8 shaped to provide positive support in the central region of the flap member 1, this support being given by laterally projecting wings or lobes 9 on the rib member to back up the inner margins of the reinforcement elements 2, thus allowing the valve as a whole to withstand an increased backpressure.

Although the valve described is intended for use in atmospheric air, valves according to the invention are also suitable for any other fluid, provided that the materials used in the construction of the valve are not affected chemically or otherwise by the fluid in the system.

WHAT WE CLAIM IS:—

1. A non-return valve of the flexible flap closure type comprising a generally cylindrical valve body, a diametral support bridge across the interior of the body and generally semi-circular valve flaps hinged on said support bridge so as to swing in the downstream direction under differential pressure from a position in which they engage a seat ring around the interior wall of the valve body and block the flow passage to a position in which they lie on opposite sides of the support bridge in planes generally parallel to the flow direction, and wherein the valve flaps are provided by the two halves of a generally circular folding flap member, have a central diametral region clamped to the support bridge and internal resilient reinforcing elements extending within said two semi-circular flaps to sustain back pressure and provide a closing bias.

2. A valve according to claim 1, wherein the resilient valve flaps have a slight natural curvature so that they are convex as seen from the downstream side.

3. A valve according to claim 1 or claim 2, wherein the opposite surfaces of the bridge support, against which the valve flaps lie in the open position, are contoured with concavities to accommodate the valve flaps and provide lateral lobes on the bridge support about which the valve flaps hinge.

4. A valve according to claim 1 or claim 2 or claim 3, wherein the central diametral region of the flap member that is clamped to the support bridge is also internally reinforced in such manner that the material of the flap member downstream of the reinforcement is in comparison.

5. A valve according to any one of the preceding claims, wherein the flap member is clamped to the bridge support by a rib member which faces upstream and is of streamline form.

6. A valve according to claim 5, wherein the rib member is so formed as to press the clamped central diametral region of the flap member into an opposing recess or concavity in the support bridge.

7. A valve according to claim 5 or claim 6, wherein the rib member is formed with lateral wings or lobes extending beyond the support bridge to sustain the inner margins

of the reinforcing elements of the flaps against back pressure.

8. A non-return valve of the flexible flap closure type, substantially as described with reference to Figures 1 and 2, or as modified either according to Figure 3 or Figure 4, of the accompanying drawings.

For the Applicant:
LLOYD WISE, BOULY & HAIG,
Chartered Patent Agents,
Norman House,
105—109 Strand,
London, WC2R 0AF.

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FIG.1

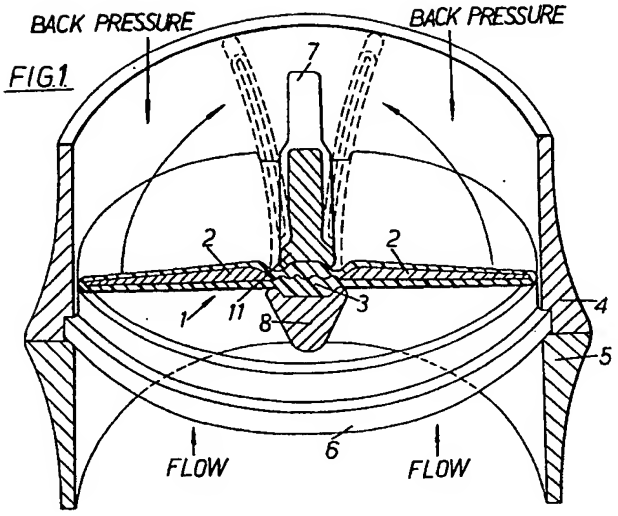

FIG.2

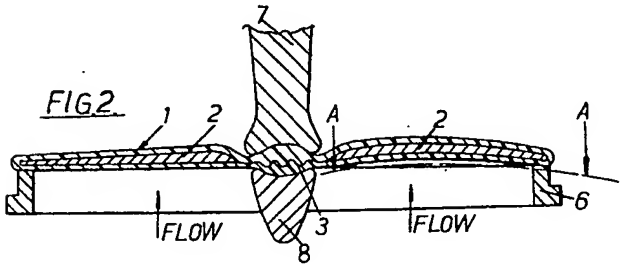

FIG.3

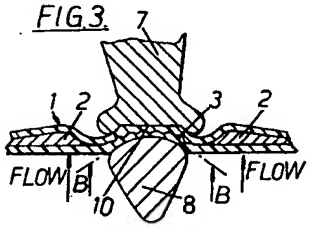

FIG.4